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(71)Applicant : FUJITSU LTD

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(72)Inventor : HOKI YOJI

KOBAYASHI KOICHI

UCHIMURA KOJI

KAWAHARA MORIHISA

NAGATOMI TSUTOMU

NAKAYASU TAKAFUMI

KANEDA HIROYUKI

KOJIMA TAKEO

TAMADA KAZUHIRO

SODA AKIHISA

TAIRA YOSHIHIKO

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(54) IMAGE-FORMING APPARATUS

(57)Abstract:

PROBLEM TO BE SOLVED: To easily correct misregistration, by relatively detecting information related to the misregistrations of color images of the other electrostatic recording units with respect to a reference image which is the color image of one of a plurality of



electrostatic recording units, and making correction to eliminate the misregistration in accordance with the detection result.

SOLUTION: When an image is to be formed, resist marks of color components are sequentially transferred onto a belt by a plurality of electrostatic recording units at a misregistration detection part 116, and then optically detected, whereby the misregistrations of the resist marks of the other color components with respect to a reference resist mark of a reference image is detected. Thereafter, when image data transmitted from a host device are developed to pixel data in an image memory 82, the write address is corrected by a misregistration correction part 124 on the basis of the detected information of the misregistration from the misregistration detection part 116 to correct the misregistration of a symmetric image with respect to the reference image at the time of printing, and printing without misregistration is carried out.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the image formation equipment which detects and amends a location gap of the mutual color picture of two or more electrostatic recording units which can be detached and attached especially freely about the image formation equipment which prints a full color image by the superposition imprint of a different color picture by two or more electrostatic recording units equipped with the print facility of electrophotography record.

[0002]

[Description of the Prior Art] Conventionally, the color picture formation equipment using electrophotography record is carrying out tandem arrangement of black (K), cyanogen (C), a Magenta (M), and the electrostatic recording unit of four colors of yellow (Y) in the conveyance direction of the detail paper. After the electrostatic recording unit of four colors scans a photoconductor drum optically based on image data, forms a latent image and develops this latent image with the color toner of a development counter, it is piled up in in the paper [record] it is conveyed with constant speed in order of yellow (Y), a Magenta (M), cyanogen (C), and black (K), is imprinted to it, and, finally performs heating fixing etc. to it through a fixing assembly.

[0003] Yellow (Y), a Magenta (M), cyanogen (C), and a black (K) electrostatic recording unit need to exchange a part of whole unit or unit, when a color toner is lost. For this reason, the electrostatic recording unit is equipped with the structure which can be easily detached and attached where equipment covering is opened. If it is in the color picture formation equipment of the structure which carried out tandem arrangement of the electrostatic recording unit of YMCK in the conveyance direction of the detail paper, in order to raise the quality of color printing on the other hand, a location gap of the toner image imprinted in each electrostatic recording unit must be reduced in in the paper [record] it moves, and the precision of color matching must be raised to it. For example, if resolution of the main scanning direction (direction which intersects perpendicularly in the conveyance direction) in the record paper, and the direction of vertical scanning (the recording paper conveyance direction) is set to 600dpi, respectively, a pixel pitch needs to be set to about 42 micrometers, for example, needs to suppress a location gap to 42 micrometers or less.

[0004] However, if it was in the color picture formation equipment of the conventional tandem die, since the electrostatic recording unit of YMCK was prepared enabling free attachment and detachment, compared with the case where fixed installation is carried out, the location gap was large, and it was difficult to realize color matching precision which suppressed the location gap to 42 micrometers or less with mechanical process tolerance or attachment precision. If it is in JP,8-85236,A in order to solve this problem for example, the resist mark of a test pattern imprinted to four places of the rectangle corner on an imprint belt, and this resist mark read by CCD, and the amount of location gaps detects on the detection coordinate of the resist mark to the absolute standard coordinate of the equipment set up beforehand, and it has amended based on the amount of gaps which detected the output coordinate location at the time of the output of the image data to a laser scanner.

[0005] However, if it is in such conventional location gap detection and location gap amendment, since detection of a location gap of the resist mark to an absolute coordinate is needed and CCD is moreover used for detection of a resist mark about yellow (Y), a Magenta (M), cyanogen (C), and all black (K) electrostatic-recording units, while processing of location gap detection took time amount, the charge of hardware increased, and the cost rise has been caused.

[0006] Moreover, equipment is using conventionally the laser scanner which scans a laser beam and forms a latent image in a photoconductor drum for an electrostatic recording unit, and, for this reason, the beam scan amended in the location decided comparatively easily by the absolute coordinate as the amount of location gaps of each unit being large by the laser scanner can be performed. However, if it is in recent years, the electrostatic recording unit which used the luminescence array which arranged many minute light emitting devices to the main scanning direction instead for the laser scanner for the miniaturization of equipment and the cost cut is proposed.

[0007] The exposure location of the beam to a photoconductor drum was decided as 1 to 1 in the physical location of an array component, and the electrostatic recording unit which used such a luminescence array is difficult to change the scan location of a beam for location gap amendment like a laser scanner. For this reason, although amending a location gap is also considered by enabling adjustment of a luminescence array mechanically, adjustment which suppresses a location gap to 42 micrometers or less is mechanically difficult. For this reason, if it was in the color picture formation equipment using a luminescence array, the big location gap of 300 micrometers is caused, for example, and there was a problem which cannot realize sufficient printing quality by the superposition of a color component.

[0008] This invention was made in view of such a conventional trouble, and aims at offering the image formation equipment which enabled it to realize highly precise location gap amendment by easy location gap detection about the image formation equipment which used the luminescence array for the electrostatic recording unit.

[0009]

[Means for Solving the Problem] Drawing 1 is the principle explanatory view of this invention. The image formation equipment which becomes this invention is arranged in the conveyance device and the recording paper conveyance direction which adsorb and convey the recording paper on the belt conveyed with constant speed, and after developing negatives of the toner component of a color which forms the latent image according to image data, and is different by the optical scan of a photoconductor drum, it is equipped with two or more electrostatic recording units imprinted on the recording paper on a belt.

[0010] If it is in this invention per image formation equipment of such a tandem die Any one color picture of two or more electrostatic recording units is used as a criteria image like drawing 1 (A). The location gap detecting element 116 which detects relatively the information about a location gap of the color picture of other electrostatic recording units, It is based on the location gap detection information detected by the location gap detecting element 116 to two or more of other electrostatic recording units except the electrostatic recording unit of a criteria image. It is characterized by forming the location gap amendment section 124 relatively amended so that a location gap of the image of other color components may be lost to a criteria image.

[0011] For example, two or more electrostatic recording units are units of black (K), cyanogen (C), a Magenta (M) and yellow (Y), and (only calling it K, C, M, and Y hereafter), by using the black image of the electrostatic recording unit of K as a criteria image, detect relatively the information about a location gap of the color picture of the electrostatic recording unit of C, M, and Y, and amend it. Since it remains on the basis of one of the four color components and it ends with location gap detection of three color components by the relative detection and the amendment of other C images, M image, and Y image of a location gap on the basis of such a K image, processing and the hardware of location gap detection become easy, and the conte down of it can carry out compared with the case where a location gap of four color components is detected to the absolute normal coordinate of equipment.

[0012] Like drawing 1 (B), after the location gap detecting element 116 imprints the resist mark 150 of

each color component in order on a belt 12 by two or more electrostatic recording units, a sensor 30 detects it optically, and a location gap of the resist mark 150 of other color components to the criteria resist mark 150 of a criteria image is detected. In this case, the location gap detecting element 116 prints the criteria resist mark 150 by the electrostatic recording unit of a color component with the strongest contrast, and detects the location gap information on the resist mark 150 by the electrostatic recording unit of other color components. Specifically, a location gap of the resist mark 150 by each electrostatic recording unit of C, M, and Y is detected by considering the black resist mark 150 of the electrostatic recording unit of K (black) as the criteria resist mark 150.

[0013] The configuration of the resist mark 150 imprinted on a belt 12 by the location gap detecting element 116 has the abbreviation wedge which consists of the 1st straight line of the main scanning direction which intersects perpendicularly in the recording paper conveyance direction, and the 2nd straight line which inclined also to any of the direction of vertical scanning which connects with the end of the 1st straight line and intersects perpendicularly in a main scanning direction and the recording paper conveyance direction. The location gap detecting element 116 imprints said resist mark 150 to two by the side of the scan start edge of the main scanning direction which intersects perpendicularly in the detail-paper conveyance direction on a belt 12, and scan termination. Time amount after detecting the 1st straight line of the criteria resist mark 150 in the direction of vertical scanning until it detects the 1st straight line of other color component resist marks 150 is measured, the conventional time in case there is no location gap is deducted from this measurement time amount, and amount of gaps delay of the direction of vertical scanning is detected.

[0014] Moreover, the 1st time amount after detecting the 1st level straight line of said criteria resist mark 150 in the direction of vertical scanning until it detects the 2nd slanting straight line is measured. The 2nd time amount after detecting the 1st level straight line of other color component resist marks until it detects the 2nd slanting straight line is measured, and the amount Δx of gaps of a main scanning direction is detected from the difference of said 1st and 2nd time amount.

[0015] The dimension conditions of the resist mark 150 imprinted on a belt 12 by the location gap detecting element 116 are said tolerance angle θ , when the sampling period of the detecting signal of S [μm] and a sensor 30 is set [the crossed axes angle of the 2nd straight line to the 1st straight line of the main scanning direction which intersects perpendicularly in the detail-paper conveyance direction of the resist mark 150 / the bearer rate of θ and a belt 12] to T [a second] for v [mm/a second] and the detection precision of said sensor $\tan \theta \leq (v \cdot T / S)$

It is set as the value to satisfy.

[0016] Moreover, when time amount permitted [crossed axes angle / of the 2nd straight line to the 1st straight line of the main scanning direction which intersects perpendicularly in the detail-paper conveyance direction of the resist mark 150 / bearer rate / of θ and a belt 12] by printing of the direction of vertical scanning of width-of-face W [mm] and one resist mark 150 in v [mm/a second] and a permission gap of the main scanning direction of said 1st straight line is set to τ [a second], it is the crossed axes angle θ $\tan \theta \leq (v \cdot \tau / W)$

It is set as the value to satisfy.

[0017] The location gap detecting element 116 divides the resist mark 150 into each color component, imprints it succeeding [two or more] the direction of vertical scanning, and computes the average from the amount of gaps detected two or more resist marks 150 of every. The detection precision of a location gap improves further by this. Although the location gap detecting element 116 may memorize the pattern of the resist mark imprinted on a belt as a bit map pattern, it is desirable to save the pattern information on the resist mark 150 as vector data, in order to reduce memory space, to develop to pixel data at the time of printing of the resist mark 150, and to imprint on said belt 12 by the electrostatic recording unit.

[0018] Let location gap detection information detected by the location gap detecting element 116 be line breadth in the amount of location gaps of the horizontal-scanning line used as the candidate for detection to a criteria image, the amount of inclinations, and a main scanning direction. That is, the location gap detecting element 116 detects the scale factor K of the line breadth of amount of bias (amount of skews)

deltaz of the direction of vertical scanning of termination which expresses the amount Δx of gaps of the main scanning direction of the start edge of the horizontal-scanning line of the image for detection, and the inclination of amount of gaps Δy of the direction of vertical scanning, and a horizontal-scanning line on the basis of the horizontal-scanning line of a criteria image, and a horizontal-scanning line as location gap information.

[0019] In case the image data transmitted from high order equipment is developed to pixel data and it develops to an image memory 82, the location gap amendment section 124 corrects a write address based on the location gap detection information from the location gap detecting element 116 so that the gap to the criteria image of an object image may be amended at the time of printing. As concrete amendment of a write address, from the amount Δx of gaps of a main scanning direction, amount of gaps of direction of vertical scanning Δy , and amount of bias (amount of skews) Δz of the direction of vertical scanning, the location gap amendment section 124 calculates the amount of gaps of the direction of vertical scanning in each pixel location on a horizontal-scanning line, amends the write address of the direction of vertical scanning in the location of the hard flow which offsets each amount of gaps, and writes pixel data in an image memory 82.

[0020] Furthermore, each of the electrostatic recording unit used with the image formation equipment which becomes this invention has the optical write-in unit which made resolution of the direction of vertical scanning high to the resolution of a main scanning direction while forming an electrostatic latent image by the optical writing according to the gradation value of pixel data on a photoconductor drum. The location gap amendment section 124 performs printing which amended the location gap using the writing of the gradation value by this optical write-in unit, and high resolution.

[0021] That is, an optical write-in unit has the write-in array 36 which arranged two or more two or more light emitting devices (luminescence segment) in the 1-pixel pitch to the main scanning direction, and writes in 1 pixel by the luminescence drive by time sharing of the 1st scan of the write-in array which synchronized with the migration for every $1/n$ pixel pitch of the record medium in the direction of vertical scanning - the n -th scan. Like drawing 1 (C) corresponding to this write-in array 36, in case the location gap amendment section 124 develops pixel data to an image memory 82, it changes and stores pixel data in the high resolution pixel data disassembled into two in the direction of vertical scanning. The location gap amendment section 124 calculates the amount of gaps of the direction of vertical scanning of each pixel location of a main scanning direction about high resolution pixel data to coincidence from the amount Δx of gaps of a main scanning direction, amount of gaps of direction of vertical scanning Δy , and amount of bias (amount of skews) Δz of the direction of vertical scanning, and amends it to it in the location of the hard flow which offsets this amount of gaps.

[0022] And synchronizing with migration of the $1/n$ pixel pitch in the direction of vertical scanning of a record medium, high resolution pixel data [finishing / n amendments] are read one by one, the luminescence drive of the write-in array is carried out by time sharing, and 1 pixel is made to write in. The gradation values at the time of changing pixel data into n high resolution pixel data of a $1/n$ pixel pitch in the direction of vertical scanning in the location gap amendment section 124 differ in whether the disassembled high resolution pixel data are located in a 1-pixel boundary in the shift by location gap amendment.

[0023] That is, in case the location gap amendment section 124 develops the high resolution pixel data by which location gap amendment was carried out to an image memory 82, it judges whether n high resolution pixel data disassembled in the direction of vertical scanning by the $1/n$ pixel pitch are located in a pixel boundary. When not located in a pixel boundary, a former gradation value is memorized as a gradation value of the 1st scan eye as it is about n disassembled high resolution pixel data. On the other hand, when located in a pixel boundary, a gradation value is divided and stored in the gradation value of the 1st scan eye - n -th scan eye about n disassembled high resolution pixel data.

[0024] When the high resolution pixel data for 1 pixel decomposed in the direction of vertical scanning which read the optical write-in unit from the image memory to generation of the gradation value of such high resolution pixel data have the gradation value of only the 1st scan eye, according to the same gradation value, the luminescence drive of the light emitting device of a write-in array is carried out by

time sharing to each timing of the 1st 1-pixel scan which serves as a $1/n$ pixel pitch in the direction of vertical scanning - the n -th scan.

[0025] On the other hand, when the high resolution pixel data for 1 pixel decomposed in the direction of vertical scanning read from the image memory have the gradation value of the gradation value of the 1st scan eye - the n -th scan eye, (when located in a pixel boundary) According to the gradation value of the 1st scan eye, the luminescence drive of the light emitting device of a write-in array is carried out to the timing of the n -th scan of n -th 1-pixel $1/n$ period to precede. According to the gradation value of the 2nd scan eye, the luminescence drive of the light emitting device of a write-in array is carried out to the timing of a $n-1$ scan eye. the [of 2nd 1-pixel $1/n$ period which follows] -- According to the gradation value of the n -th scan eye, the luminescence drive of the light emitting device of a write-in array is carried out to the timing of the 1st scan eye of -- and 1st 1-pixel $1/n$ period which follows.

[0026] For this reason, by printing by high resolution pixel data [finishing / amendment of an image memory], the printing result of having doubled resolution in the direction of vertical scanning is obtained, and even if it is printing which used the write-in array to which the optical record location was physically fixed to the photoconductor drum, the location gap amendment of the object image can be carried out with high degree of accuracy to a criteria image. The precision of the location gap amendment at the time of causing the location gap from which a scan line becomes slanting to criteria Rhine especially can be improved.

[0027] The write-in array 36 of an optical write-in unit is an LED array which arranged two or more LED chips in the 1-pixel pitch to the main scanning direction. An optical write-in unit makes printing resolution of the direction of vertical scanning the integral multiple of the resolution of a main scanning direction (n times), for example, twice, and 3 times by the LED array. For example, the printing resolution of a main-sub scanning direction is 600dpi, and sets printing resolution of the direction of vertical scanning to twice as many 1200dpi as this or 3 times as many 1800dpi as this to this. The luminescence mechanical component of an optical record unit controls the depth of the latent image which carries out pulse luminescence by the count according to a gradation value and which is generated to a photoconductor drum between the luminescence periods of each light emitting device of a write-in array.

[0028] When the line breadth of a main scanning direction differs to criteria width of face, in order to make criteria width of face agree, amendment which compresses or elongates pixel data in a main scanning direction is performed. That is, the location gap amendment section 124 asks for the number of amendment pixels (N/K) to which the several N s predetermined pixel of a main scanning direction was multiplied by the inverse number of the scale factor $K (=L/L_0)$ which $**$ (ed) line breadth L of the main scanning direction of an object image with the line breadth L_0 of the main scanning direction of a criteria image, and it was reduced or expanded, and writes in the gradation value of the pixel data compressed or elongated to each pixel address of this number (N/K) of amendment pixels in the main scanning direction.

[0029] When it explains concretely, the location gap amendment section 124 The amendment printing result which multiplied by the inverse number of a scale factor K to the printing result of the pixel data before amendment, and was reduced or expanded to the main scanning direction is searched for. It samples in each location of the number (N/K) of amendment pixels which multiplied the several N s predetermined pixel of a main scanning direction by the inverse number of the scale factor K of the line breadth of the main scanning direction of an object image, and reduced or expanded this amendment printing result to it, and the gradation value for every pixel after line breadth amendment is generated.

[0030] As an equipment configuration of the image formation equipment which becomes this invention, the body of equipment consists of the engine section and the controller section, forms said two or more electrostatic recording units and the location gap detecting element 116 in the engine section, and forms the location gap amendment section 124 in the controller section. In this case, in case the location gap amendment section 124 prepared in the controller section develops the image data transmitted from external high order equipment as pixel data to an image memory, it performs location gap amendment based on the location gap detection information supplied from the location gap detecting element 116 of

the engine section.

[0031] Moreover, in case the location gap amendment section 124 prepared in the controller section reads the image data of an image memory and outputs it to the engine section, it develops to the buffer memory prepared in the middle of the output path, and it may be made to perform location gap amendment based on the location gap detection information supplied from the location gap detecting element 116 of the engine section on this buffer memory.

[0032]

[Embodiment of the Invention]

< eye Structure drawing 2 of the equipment of the explanation 1. 1st example of the amendment 6. 2nd-4th example of the structure 2. hardware configuration of the equipment of the >[degree]1. 1st example and function 3. location gap detection 4. location gap amendment 5. line breadth is drawing explaining the internal structure of the 1st example of the image formation equipment which becomes this invention. The conveyance belt unit 11 for making a record medium, for example, a record form, convey is formed in the interior of the body 10 of equipment, and the conveyance belt unit 11 is equipped with the endless belt 12 made from the dielectric materials, for example, suitable synthetic-resin ingredient, of *****, enabling free rotation. The surroundings of four rollers 22-1, 22-2, 22-3, and 22-4 are built over the endless belt 12. It is equipped with the conveyance belt unit 11 free [attachment and detachment] to the body 10 of equipment.

[0033] A roller 22-1 functions as a driving roller, and a driving roller 22-1 carries out a transit drive with constant speed at the clockwise rotation which shows the endless belt 12 by the arrow head with a drive (not shown). Moreover, a driving roller 22-1 functions also as an AC removal roller which removes a charge from the endless belt 12. A roller 22-2 functions as a free ** roller, and the free ** roller 22-2 functions also as an electrification roller which gives a charge to the endless belt 12.

[0034] Both a roller 22-3 and 22-4 function as a guide idler, approach a driving roller 22-1 and the follower roller 22-2, and are arranged. The bottom transit section of the endless belt 12 between the follower roller 22-2 and a driving roller 22-1 forms the moving trucking of the recording paper. The recording paper is accumulated in the hopper 14, and it lets it out one sheet at a time from the recording paper of the topmost part of a hopper 14 with a pickup roller 16, and is introduced into the recording paper moving trucking by the side of [the follower roller 22-2 side of the endless belt 12 to] Belt A with the chart-drive roller 20 of a pair through the recording paper guide path 18, and the recording paper which passed recording paper moving trucking is discharged from a driving roller 22-1.

[0035] Since the endless belt 12 is charged with the follower roller 22-2, when the detail paper is introduced into detail-paper moving trucking from the follower roller 22-2 side, the endless belt 12 is adsorbed electrostatic, and a location gap of the detail paper under migration is prevented. On the other hand, since the driving roller 22-1 by the side of discharge functions as an electric discharge roller, a charge is removed in the part to which the endless belt 12 touches a driving roller 22-1. For this reason, without removing a charge and being involved in the belt lower part, in case a driving roller 22-1 is passed, from the endless belt 12, it exfoliates easily and the detail paper is discharged.

[0036] In the body 10 of equipment, four sets of the electrostatic recording units 24-1, Y, M, C, and K, 24-2, 24-3, and 24-4 are prepared, and it has the tandem construction arranged in order of Y, M, C, and K toward the downstream at the serial from the upstream along with the recording paper moving trucking of the belt bottom specified between the follower roller 22-2 of the endless belt 12, and a driving roller 22-1.

[0037] The point which uses a yellow toner component (Y), a Magenta toner component (M), a cyanogen toner component (C), and a black toner component (B) as a developer is different, and the other structure of the electrostatic recording unit 24-1 to 24-4 is the same. For this reason, the electrostatic recording unit 24-1 to 24-4 carries out imprint record of a yellow toner image, a Magenta toner image, a cyanogen toner image, and the black toner image in piles one by one, and forms a full color toner image in in the paper [record] it moves along with the recording paper moving trucking of the endless belt 12 top.

[0038] Drawing 3 is the sectional view taking out and showing one of the electrostatic recording units

24-1 to 24-4 of drawing 2 . The electrostatic recording unit 24 is equipped with a photoconductor drum 32, and the rotation drive of the photoconductor drum 32 is clockwise carried out at the time of record actuation. Above a photoconductor drum 32, before being constituted as a corona-electrical-charging machine or a scorotron electrification machine, the electrification machine 34 is arranged, and the rotation front face of a photoconductor drum 32 is charged in a uniform charge with the pre-electrification vessel 34.

[0039] In the electrification field of a photoconductor drum 32, LED array 36 which functions as an optical write-in unit is arranged, and an electrostatic latent image is written in by the light by which outgoing radiation was carried out by scanning of LED array 36. Namely, the light emitting device arranged in the main scanning direction of LED array 36 is driven based on the gradation value of the pixel data (dot data) developed from the image data offered as printed information from a computer, a word processor, etc., and, for this reason, an electrostatic latent image is written in as a dot image.

[0040] The electrostatic latent image written in the photoconductor drum 32 is developed electrostatic as an electrification toner image by the predetermined color toner by the development counter 40 arranged above the photoconductor drum 20. The electrification toner image of a photoconductor drum 20 is imprinted by the recording paper electrostatic with the conductive imprint roller 42 located caudad. That is, the electrostatic nature imprint roller 42 is arranged through a minute clearance through the endless belt 12 between photoconductor drums 32, an electrification toner image gives the charge of reversed polarity to the recording paper conveyed with the endless belt 12, and, thereby, the electrification toner image on a photoconductor drum 32 is imprinted electrostatic in the record paper.

[0041] The residual toner which remained without the recording paper imprinting has adhered to the front face of a photoconductor drum 32 through an imprint process. This residual toner is removed to a photoconductor drum 32 by the toner purifier 43 formed in the downstream of recording paper moving trucking. The removed residual toner is returned to a development counter 40 by the screw conveyor 38, and is again used as a development toner.

[0042] In case the detail paper passes the detail-paper moving trucking between driving rollers 22-1 from the follower roller 22-2 of the endless belt 12 again with reference to drawing 2 In response to the imprint by the superposition of the toner image of four colors of Y, M, C, and K, a full color image is formed of the electrostatic recording unit 24-1 to 24-4. It is sent out toward the heating roller type heat anchorage device 26 from a driving roller 22-1 side, and heat fixing to the record form of a full color image is performed. The record form with which heat fixing ended is arranged and accumulated by the stacker 28 which passed the guide idler and was formed in the upper part of the body of equipment.

[0043] To the belt side of the endless belt 12 bottom of the conveyance belt 10, the sensor 30-1 of a pair and 30-2 are installed in the direction which intersects perpendicularly in the belt migration direction, and only the front sensor 30-1 appears in the state of drawing 2. This sensor 30-1 and 30-2 are used in order to read optically the resist mark for the location gap detection imprinted on the endless belt 12 on the occasion of the location gap detection by this example.

[0044] Drawing 4 is drawing explaining the fetch condition of the conveyance belt unit 11 prepared in the interior of the body 10 of equipment of drawing 2 , and the attachment-and-detachment structure of the electrostatic recording unit 24-1 to 24-4 prepared in the conveyance belt unit 11. Left-hand side is first established in the covering 54 which can be freely opened and closed at the supporting point in the upper part of the body 10 of equipment. The frame 55 has been arranged in the body 10 of equipment, and the pin 56 is arranged in the two upper parts of a frame 55.

[0045] On the other hand, the frame 58 which faces the frame 55 by the side of the body 10 of equipment was formed in the side face of the conveyance belt unit 11 taken out and shown in the upper part, and the pin hole has opened in the location which faces the pin 56 of a frame 58. For this reason, it can extract to the upper part from the pin 56 by the side of the body 10 of equipment by opening covering 54 and pulling up the conveyance belt unit 11 up.

[0046] The electrostatic recording unit 24-1 to 24-4 with which the conveyance belt unit 11 was equipped is attached by inserting in the pin 50 with which the side face of the electrostatic recording unit 24-1 to 24-4 was equipped to the attachment slot 52 opened in the upper part of the tie-down plate 51

arranged on side-face both sides. The attachment slot 52 is forming the straight slot which has width of face comparable as a pin 50 in the bottom following the part opened to the upside V character mold, setting a pin 50 by the attachment slot 52, and pushing into the bottom, and can be correctly positioned in the predetermined location on the conveyance belt unit 11. Moreover, it can remove easily by pulling up up like the electrostatic recording unit 24-3 to supply a toner to the development record unit 24-1 to 24-4, or perform maintenance.

2. A hardware configuration and a functional diagram 5 are block diagrams showing the hardware configuration of the image formation equipment in this example. The hardware of this example consists of the engine section 60 and the controller section 62. The mechanical controller 64 which performs control action of the print station section of the conveyance belt unit 11, the electrostatic recording unit 24-1 - 24-4 grade shown in drawing 2 is formed in the engine section 60.

[0047] To the mechanical controller 64, MPU66 for sensor processing which performs location gap detection processing in this example is formed. To MPU66 for sensor processing, the sensor 30-1 of a pair currently installed in the lower part of the endless belt 12 and the detecting signal from 30-2 are inputted through AD converter 68-1 and 68-2. The mechanical controller 64 is connected a controller 62 side through the engine section connector 70. In addition, the print station prepared in the engine section 60 takes out and shows LED array 36-1 prepared in the endless belt 12 and each electrostatic recording unit of Y, M, C, and K, 36-2, 36-3, and 36-4.

[0048] MPU72 for controllers is formed in the controller section 62. To MPU72 for controllers, the personal computer 92 as high order equipment is connected through the interface processing section 74 and the control section connector 76. The personal computer 92 was equipped with the driver 96 for carrying out printing processing of the color picture data offered from the application program 94 of arbitration, and has connected the driver 96 to the control section connector 76 of the controller section 62 through the personal computer section connector 98.

[0049] The image memory 82-1 which develops and stores in pixel data (dot data) each image data of Y, M, C, and K which were transmitted from the personal computer 92, 82-2, 82-3, and 82-4 are prepared in MPU72 for control of the controller section 62. On the other hand, it can connect with the engine section 60 through the interface processing section 78 and the controller section connector 80, and MPU72 for controllers can receive the location gap information detected by the engine section 60 side in the interface processing section 78, and can perform location gap amendment for the pixel data of each image developed by the image memory 82-1 to 82-4.

[0050] In case a controller MPU 72 develops each color pixel data to an image memory 82-1 to 82-4, it is equipped with the addressing section 84 in order to address. If the addressing section 84 is followed, the address translation section 86 is formed. The address translation section 86 performs address translation for location gap amendment based on the location gap information offered from the engine section 60 side through the interface processing section 78.

[0051] If an image memory 82-1 to 82-4 is followed, the resolution transducer 88 is formed. Corresponding to Y, M, C, and K, buffer memory 90-1, 90-2, 90-3, and 90-4 are prepared in the resolution transducer 88. It decomposes in the direction of vertical scanning in LED array 36-1 to 36-4 (the form conveyance direction), and the resolution transducer 88 changes into two high-resolution pixel data the pixel data [finishing / location gap amendment] read from the image memory 82-1 to 82-4.

[0052] For example, although a main scanning direction is 600dpi in the resolution transducer 80 supposing the resolution at the time of being developed with an image memory 82-1 to 82-4 is main scanning direction 600dpi and direction of vertical scanning 600dpi, it is changed into the high resolution pixel data of 1200dpi about the direction of vertical scanning. Conversion to the high resolution pixel data which become twice in this direction of vertical scanning can raise the printing precision in location gap amendment when the scanning line becomes slanting in the engine section 60. In addition, it is not limited to $n=2$, for example, if it is $n=3$, about the direction of vertical scanning, conversion to the high resolution pixel data of 1800dpi will be performed.

[0053] Drawing 6 is the explanatory view in which taking out the sensor 30-1 formed in the engine section 60 side of drawing 5, and one of the 30-2, and showing the 1 operation gestalt. A sensor 30

arranges a light emitting device 100 in the direction of the incident angle θ_1 to the endless belt 12, condenses the light from a light emitting device 100 with the image formation lens 102, and is carrying out image formation of the beam spot on the endless belt 12. In the direction of the outgoing radiation angle θ_2 over this beam spot, a photo detector 106 is arranged through a condenser lens 104 and a slit 105.

[0054] The incident angle θ_1 of a light emitting device 100 and the outgoing radiation angle θ_2 of a photo detector 106 decide that the optimal amount of reflected lights is obtained in 45 degrees - 75 degrees here. This sensor 30 detects optically the resist mark 150 for the location gap detection imprinted by the electrostatic recording unit on the endless belt 12. That is, if it is in the location of a belt side without the resist mark 150, it is fully reflected, incidence of the incident light from a light emitting device 100 is carried out to a photo detector 106, and the light-receiving signal from a photo detector 106 has become more than convention level. If the resist mark 150 reaches a detection location by migration of the endless belt 12, since it is a minute toner component, incident light can reflect irregularly, the amount of reflected lights to a photo detector 106 can fall, and the resist mark 150 can detect the resist mark 150 by the level fall of the light-receiving signal from the photo detector 106 at this time.

[0055] Drawing 7 is the block diagram showing the resolution transducer 88 prepared in the controller section 60 of drawing 5. Buffer memory 90, the interface section 110, the addressing section 112, and the conversion control section 114 are formed like illustration in every Y, M, C, and K at the resolution transducer 88. Pixel data [finishing / the location gap amendment from image memory / of drawing 5 / 82-1 - 82-4 side] are inputted into the interface section 110.

[0056] The location gap amendment data based on the location gap information detected by the engine section 60 side are supplied to the conversion control section 114 via the interface processing section 78 prepared in the controller section 62 of drawing 5. Buffer memory 90 will be changed into the high-resolution pixel data which decomposed 1 pixel of the direction y of vertical scanning into two, and were made into 2 pixels if a main scanning direction x and the form conveyance direction are made into the direction y of vertical scanning for the direction which intersects perpendicularly in the form conveyance direction of LED array 36-1 to 36-4 in the engine section 60.

[0057] By resolution conversion to this buffer memory 90 top, although the main scanning direction x of 600dpi and the pixel data whose direction y of vertical scanning was similarly 600dpi is the same as that of 600dpi about a main scanning direction x, it is changed into the high resolution of twice as many 1200dpi as this about the direction y of vertical scanning. Two high resolution pixel data which decomposed 1 pixel will be read from buffer memory 90, and write-in record by time-sharing luminescence of the 1st scan line eye and the 2nd scan line eye will be performed.

[0058] Conversion to the high resolution pixel data in this resolution transducer 88 and the detail of the record writing in the engine section 60 using high resolution pixel data are further clarified by next explanation. Drawing 8 is the functional block diagram of the image formation equipment in this example realized by the hardware configuration of drawing 5. In drawing 8, the image formation equipment in this example has fundamentally two functions, the location gap detecting element 116 and the location gap amendment section 124. The function as a location gap detecting element 116 is realized by MPU60 for sensor processing prepared in the engine section 60 of drawing 5. Moreover, the function as the location gap amendment section 124 is realized by MPU72 prepared in the controller section 62 of drawing 5.

[0059] To the location gap detecting element 116, the sensor 30-1 formed in the endless belt 12 bottom of the engine section 60 of drawing 5 and the detecting signal of 30-2 are given. The resist pattern write-in section 118, the location gap operation part 120, and the location gap information storing section 122 are formed in the location gap detecting element 116. The resist pattern write-in section 118 makes the resist pattern for location gap detection write in on the endless belt 12 via the LED mechanical component 130 by each LED array 36-1 to 36-4 of Y, M, C, and K in the case of location gap detection.

[0060] The resist pattern for this location gap detection is imprinted by two by the side of the start edge of the scanning zone in the main scanning direction which intersects perpendicularly in the conveyance

direction of the endless belt 12, and termination, and is detected by the sensor 30-1 and 30-2, respectively. If it is in the location gap detection in this example, the printing image of K with the strongest contrast is used as a criteria image among four colors of Y, M, C, and K, and a location gap of each printing image of YMC to this K criteria image is detected.

[0061] The printing information with the pattern configuration to clarify on a resist mark is specifically held by next explanation at the resist pattern write-in section 118, and 1 or two or more resist marks are imprinted on an endless belt by the juxtaposition drive of LED array 36-1 to 36-4 of Y, M, C, and K, using this resist mark printing information. It is desirable to have as vector information, to develop to bit map data and to carry out write-in record by the LED mechanical component 130, although you may have the information on the resist mark held in the resist pattern write-in section 118 by the bit map pattern. The location gap operation part 118 calculates the location gap information on other resist marks of Y, M, and C on the basis of K (black) resist mark with the strongest contrast based on the detection information on the resist mark of a sensor 30-1 and four colors of Y, M, C, and K which were detected by 30-2.

[0062] As location gap information searched for by the location gap operation part 120 The amount Δx of gaps of the main scanning direction in the start edge location of the scanning line of the main scanning direction of the object image on the basis of the scanning line of the main scanning direction of K, It is the scale factor $K (=L/L_0)$ of the detection width of face L of amount of changes (amount of skews) Δz of the direction of vertical scanning which similarly shows the inclination in amount of gaps Δy of the direction of vertical scanning in a start edge location, and scanning-line termination, and the object scanning line to the criteria width of face L of K principal direction scanning line.

[0063] Thus, the location gap information computed by the location gap operation part 120 is stored in the location gap information storing section 122. Since location gap information stored in the location gap information storing section 122 is based on K, all the location gap information on K is 0, therefore the location gap information on K will not be required, and the three remaining location gap information, Y, M, and C, will be stored.

[0064] The location gap amendment section 124 is equipped with the location gap amendment information storing section 126 and the address translation section 128. The location gap amendment information based on each location gap information of Y, M, and C on the location gap information storing section 122 detected by the location gap detecting element 116 is stored in the location gap amendment information storing section 126. The address translation section 128 performs address translation for the location gap amendment at the time of developing pixel data to an image memory 82-1 to 82-4 based on the location gap amendment information stored in the location gap amendment information storing section 126. If the function of this address translation section 128 is in the controller section 62 of drawing 5, it is realized by forming the address translation section 86 of dedication.

[0065] The address translation for the location gap amendment by the address translation section 128 is unnecessary about expansion of the pixel data about the K image memory 82-4, and performs address translation for location gap amendment to each of the remaining image memories 82-1 to 82-3 of Y, M, and C in the case of expansion of pixel data. Moreover, address translation for the location gap amendment by the address translation section 128 is not performed about all the location gap information detected by the location gap detecting element 116, but is performed only about the information to which the value of location gap information exceeded the threshold defined beforehand. For example, since the pixel pitch of 600bpi is about 42 micrometers, it is amended about a location gap of 42 micrometers or more.

[0066] Furthermore, in case the location gap amendment section 124 reads pixel data from the image memory 82-1 to 82-4 of Y, M, C, and K with which location gap amendment ended and carries out a write-in drive by the LED mechanical component 130, it also performs control of resolution transform processing by the resolution transducer 88-1 to 88-4 prepared in the middle of the data transfer path. This resolution transform processing decomposes 1 pixel in the direction y of vertical scanning, changes it into two high resolution pixel data, and generates the gradation value of each high resolution data.

[0067] For this reason, although the resolution transducer 88-1 to 88-4 was separated from the location

gap amendment section 124 and is prepared if it is in functional block of drawing 8, of course, you may include in the location gap amendment section 124. As for a merely actual equipment configuration top, it is desirable to prepare the circuit module as a resolution transducer of dedication. Drawing 9 is the overall flow chart of the printing processing actuation in the image formation equipment in this example equipped with the function of drawing 8. When the power source of equipment is switched on first, at step S1, initialization processing defined beforehand is performed and location gap detection processing of step S2 is in this initialization processing. When location gap detection processing of step S2 ends, at step S3, the existence of the printing demand from the personal computer of a high order is checked, and it is.

[0068] If there is a printing demand, it will progress to step S4, and in case the image data transmitted from a personal computer is developed to an image memory, location gap amendment processing is performed by step S4. The location gap amendment by the address translation section 128 of drawing 8 and resolution transform processing by the resolution transducer 88-1 to 88-4 are included in this location gap amendment processing.

[0069] Then, it waits for the printing preparation completion by the side of the engine section 60 at step S5, and printing processing by the engine section 60 is performed at step S6. Moreover, if it is confirming whether there are any directions of color gap adjustment processing at step S7 and directions of color gap adjustment processing are during processing, it will return to step S2 and the same location gap detection processing as the time of starting of a power up will be performed again.

[0070] As color gap adjustment directions of step S7, there is manual directions by the operator or directions by the command from the personal computer of a high order. Furthermore, a location gap originates in the mechanical factor of an electrostatic recording unit prepared in the engine section 60, is changed with the environmental temperature in equipment, and does things. Then, the elapsed time from a power up is supervised, and whenever it reaches the time amount according to the time schedule set up beforehand, location gap detection processing of step S2 can also be performed automatically. What is necessary is just to lengthen processing spacing of location gap detection as execution-time spacing of location gap detection processing is short and the elapsed time from powering on becomes long, since the temperature fluctuation in equipment is [the time schedule in this case] large immediately after powering on.

3. Location gap detection drawing 10 is the principle explanatory view of location gap detection of other each set elephant images of Y, M, and C on the basis of strongest K (black) image of the contrast by the location gap detecting element 116 of drawing 8.

[0071] In drawing 10, black printing Rhine with AT4 form width of face 134 which intersects perpendicularly in the form conveyance direction is made into criteria printing Rhine 132. To this criteria printing Rhine 132, printed object printing Rhine 130 originated in the mechanical location gap of the electrostatic recording unit of object printing Rhine to the electrostatic recording unit of K etc., and has caused the location gap to ideal printing Rhine 148.

[0072] Similarly three elements of the amount Δx of location gaps of the main scanning direction of the starting point 142 and amount of bias showing inclination of amount of location gaps Δy [of the direction of vertical scanning of the starting point 142] and Rhine further defined by amount of gaps of direction of vertical scanning of terminal point 144 (amount of skews) Δz can define the location gap of object printing Rhine 140 to this ideal printing Rhine 148. In ideal printing Rhine 148, it is printing Rhine which was parallel and corresponded to criteria printing Rhine 132 of K (black) here. Therefore, the amount Δx of main scanning direction location gaps, amount of direction location gaps of vertical scanning Δy , and amount of bias Δz to ideal printing Rhine 148 mean the amount of gaps to criteria printing Rhine 132 of K.

[0073] Furthermore, if it is in this example, the scale factor K of the line breadth of object printing Rhine 140 to the form width of face 134 of criteria printing Rhine 132 is detected as one of the amounts of location gaps. Detection of the location gap information on drawing 10 imprints a resist mark like drawing 11 to two by the side of the start edge of the main scanning direction of the endless belt 12, and termination, and asks for it by detecting this by the sensor 30-1 and 30-2.

[0074] if shown in drawing 11 -- the object for black from the upstream of the form conveyance direction -- resist mark 150K, resist mark 150C for cyanogen, and the object for Magentas -- resist mark 150M and resist mark 150Y for yellow are imprinted at fixed spacing. This resist mark consists of the 1st straight line 154 of a main scanning direction, and the 2nd straight line 156 arranged with the predetermined tilt angle θ to the 1st straight line 154 like drawing 12. That is, the 2nd straight line 156 is a straight line which had an inclination also to any of a main scanning direction and the direction of vertical scanning. Moreover, although the 1st straight line 154 and the 2nd straight line 156 are connected by the end, even if separated a little, they are satisfactory.

[0075] If reading in the sensor 30 shown in drawing 6 is possible for the size of the 1st straight line 154 in this resist mark 150, and the 2nd straight line 156, it is good. Moreover, the crossed axes angle θ of the 1st straight line 154 and the 2nd straight line 156 is $\tan\theta \leq (v \times T / S)$ when the sampling period according v [mm/a second] and the detection precision of a sensor to the AD converter of the detecting signal of S [μm] and a sensor in the bearer rate of an endless belt is set to T [a second], if shown in drawing 12.

It is set as the satisfied value.

[0076] Drawing 13 is drawing explaining other decision approaches of the 1st straight line 154 and the 2nd straight line 156 in the resist mark 130 used by the location gap detection in this example. In this case, when time amount which is alike, therefore is permitted [bearer rate / of an endless belt] by printing of the direction of vertical scanning of W [μm] and one resist mark in v [mm/a second] and the permission gap width of face of the main scanning direction of the 1st straight line 154 is set to τ [a second], the crossed axes angle θ is $\tan\theta \leq (v \times \tau / W)$.

What is necessary is just to set it as the satisfied value.

[0077] Moreover, you may be the resist mark 158 opened to left-hand side like drawing 14 (A) in addition to the resist mark opened to the lower right side like drawing 11 as a resist mark used for location gap detection, and the resist mark 160 opened to the ***** bottom like drawing 14 (B). furthermore -- if it is in actual location gap detection -- drawing 15 -- like -- the conveyance direction of the endless belt 12 -- the object for black -- resist mark 150K, resist mark 150C for cyanogen, and the object for Magentas -- resist mark 150M and resist mark 150Y for yellow are imprinted in succession two or more. and each object for black -- a location gap of the resist marks 150C, 150M, and 150Y for the object for cyanogen to resist mark 150K, the object for Magentas, and yellow is calculated, an average value is calculated, and the detection error by a rose, a noise, etc. at the time of a resist mark imprint is suppressed by this.

[0078] Drawing 16 is a timing diagram explaining the location gap detection based on the transfer pulse when reading the resist marks 150K, 150C, 150M, and 150Y of drawing 11 by the lower sensor 30-1. drawing 16 (A) -- sensor 30- of drawing 11 -- the mark detection point which is a detection pulse in the case of having no location gap when reading the resist marks 150K, 150C, 150M, and 150Y by 1 one by one, and intersects the sensing line 152-1 of a sensor 30-1 -- the detection pulses 170 and 172 and ... as 184 -- time of day tk_1 and tk_2 and ... it is obtained by ty_2 .

[0079] in this case, the object for black -- the object for black since there is no location gap in the resist marks 150C, 150M, and 150Y for other objects for cyanogen to resist mark 150K, the object for Magentas, and yellow -- the detection pulses 174 and 176 of other resist marks on the basis of the detection pulse 170, 172 of resist mark 150K, and ... the conventional times TH_1 and TH_2 which specified the elapsed time to the detection pulse of 184 beforehand, and ... it is TH_6 .

[0080] for example, the object for top black -- about the detection pulse 174 of the 1st straight line of the main scanning direction of following resist mark 150C for cyanogen to the detection pulse 170 of the 1st straight line of the main scanning direction of resist mark 150K, it is the conventional time TH_1 decided by the difference $(tc_1 - tk_1)$ of the detection time of day tc_1 and the detection time of day tk_1 . Similarly, about the detection pulses 172 and 176 of the 2nd straight line of the direction of slant of the resist marks 150K and 150C, since there is no gap, it is the conventional time TH_2 .

[0081] Drawing 16 (B) is a detection pulse as shown in drawing 17, when resist mark 150C for cyanogen of drawing 11 shifts in the direction of vertical scanning. If shown in drawing 17, the

imprinted resist mark has shifted in the direction of vertical scanning like resist mark 162C to resist mark 150C for cyanogen of the right location shown with a broken line. For this reason, both the pulses 174,176 corresponding to the detecting point of resist mark 150C on the detection scanning line 152-1 of a sensor are shifted like the detection pulse 186,188 used as a detecting point. For this reason, the detection pulse 186,188 is acquired like drawing 16 (B) a little early than the detection pulse 174,176 when you have no location gap.

[0082] Then, the difference ($T_{c1} - T_{k1}$) of the elapsed time $T1$ of the detection pulse 186 of the cyanogen to the black reference pulse 170 is searched for, and the gap time amount $\Delta T1$ is found by lengthening this elapsed time $T1$ from the conventional time $TH1$. If the bearer rate of a form is set to v [mm/a second] here, amount of direction gaps of vertical scanning Δt_{ay} can be found by multiplying the belt passing speed v by time difference $\Delta T1$.

[0083]